SECTION A. TECHNICAL NOTES

OVERVIEW

The 1993 National Survey of Recent College Graduates (NSRCG:93) is sponsored by the National Science Foundation (NSF), Division of Science Resources Studies (SRS). The NSRCG is one of three data collections covering personnel and graduates in science and engineering. The other two surveys are the National Survey of College Graduates (NSCG) and the Survey of Doctoral Recipients (SDR). Together, they constitute the NSF's Scientists and Engineers Statistical Data System (SESTAT). These surveys serve as the basis for developing estimates and characteristics of the total population of scientists and engineers in the United States.

The first NSF-sponsored NSRCG (then known as New Entrants) was conducted in 1974. Subsequent surveys were conducted in 1976, 1978, 1979, 1980, 1982, 1984, 1986, 1988, 1990, and 1993. In the initial survey, data were collected only on bachelor's degree recipients, but all ensuing surveys included both bachelor's and master's degree recipients.

For the NSRCG:93, the school and graduate sampling was done by the Institute for Survey Research (ISR) at Temple University, and the survey collection, processing, weighting, and table production were conducted by Westat, Inc. A sample of 275 colleges and universities was asked to provide lists of eligible bachelor's and master's degree recipients. From these lists, a sample of 25,785 graduates (16,585 bachelor's and 9,200 master's) was selected. These graduates were interviewed between May and November of 1993. Computer-assisted telephone interviewing (CATI) served as the primary means of data collection. Mail data collection was used only for those who could not be reached by telephone. The unweighted response rate for institutions was 99 percent, and the unweighted response rate for graduates was 86 percent. The weighted response rates were 99 and 84 percent, respectively.

The NSRCG questionnaire was expanded and revised substantially by NSF for the 1993 survey. This revision was done in coordination with similar revisions to the other SESTAT surveys. Topics covered in the survey include:

- Educational experience before and after obtaining degree;
- Graduate employment characteristics including occupation, salary, unemployment, underemployment, and post-degree work-related training;
- Relationship between education and employment; and
- Graduate background and demographic characteristics.

SAMPLE DESIGN

The NSRCG used a two-stage sample design. In the first stage, a stratified nationally representative sample of 275 institutions was selected with probability proportional to size. There were 196 self- representing institutions, also known as certainty units. Measures of size were devised to account for the relative rareness of certain specialty and nonspecialty major fields of study. Universities with a high proportion of Hispanic, black, and foreign students were oversampled by doubling their measure of size. The 79 noncertainty institutions were implicitly stratified by sorting the list by ethnic status, region, public/private status, and presence of agriculture as a field of study. Institutions were then selected by systematic sampling from the ordered list.

GRADUATE SAMPLE

The second stage of the sampling process involved selecting graduates within the sampled institutions by cohort. As a first step, each participating institution was asked to send lists of graduates to ISR. Within graduation year (cohort), each eligible graduate was then classified into one of 42 strata based on the graduate's major field of study and degree status.

Table A-1 is a list of the major fields and the corresponding sampling rates by cohort and degree. These rates are overall sampling rates for the major field, so they include the institution's probability of selection and the within-institution sampling rates. To achieve the within-institution sampling rate, the overall rate was divided by the institution's probability of selection.

Table A-1. Major fields and corresponding sampling rates, by cohort and degree: 1993

Major field	1990 bachelor's rate	1990 master's rate	1991 bachelor's rate[1]	1991 master's rate[1]	1992 bachelor's rate	1992 master's rate
Chemistry	1/48	1/12	1/48 (1/24)	1/6	1/24	1/6
Physics/astronomy	1/12	1/12	1/12 (1/6)	1/6	1/6	1/6
Other physical sciences	1/24	1/12	1/6	1/6	1/6	1/4
Mathematics/statistics	1/48	1/24	1/48	1/24	1/48	1/24
Computer sciences	1/72	1/48	1/72	1/24 (1/48)	1/72	1/48
Environmental sciences	1/3	1/3	1/24	1/6 (1/12)	1/24	1/12
Aero/astronautical engineering	1/12	1/3	1/12	1/6	1/12	1/6
Chemical engineering	1/12	1/6	1/12	1/3	1/12	1/3
Civil engineering	1/24	1/12	1/24	1/12 (1/24)	1/24	1/24
Electrical engineering	1/72	1/48	1/72	1/24	1/72	1/24
Industrial engineering	1/12	1/6	1/12 (1/6)	1/3	1/12	1/4
Materials engineering	1/2	1/2	1/3 (1/2)	1/2 (1/4)	1/2	1/4
Mechanical engineering	1/48	1/12	1/48	1/12 (1/24)	1/48	1/24
Other engineering	1/72	1/24	1/72	1/12 (1/24)	1/72	1/24
Biological sciences	1/72	1/24	1/44	1/12 (1/24)	1/144	1/24
Agricultural sciences	1/24	1/12	1/24 (1/12)	1/6 (1/12)	1/12	1/12
Psychology	1/144	1/24	1/144	1/12 (1/24)	1/144	1/24
Economics	1/72	1/12	1/72	1/12 (1/24)	1/72	1/24
Sociology/anthropology	1/48	1/12	1/72	1/6 (1/12)	1/72	1/12
Other social sciences	1/144	1/24	1/144	1/12 (1/24)	1/144	1/24
No field	1/48	1/144	1/24 (1/12)	1/24	1/24	1/24

[1] Sampling rates in some categories were changed during sampling. For these categories, the second set of rates is shown in parentheses.

SOURCE: National Science Foundation, 1993 National Survey of Recent College Graduates

Graduate Eligibility

To be included in the sample, the graduates had to meet all of the following criteria:

- They received a bachelor's or master's degree in an eligible major from the college or university from which they were sampled.
- They received their degree within the time period for which they were sampled. For the 1993 study, there were three time frames (April 1990 through June 1990, July 1990 through June 1991, and July 1991 through June 1992).
- They were under the age of 76 and alive during the week of April 15, 1993 (the reference week).
- They lived in the United States during the reference week.

Data Collection and Response

Prior to graduate data collection, it was first necessary to obtain the cooperation of the sampled institutions that provided lists of graduates. Since the sample included graduates from three time frames between 1990 and 1992, lists were collected from the institutions in three waves. The response rate for the institution collection was 99.4 percent.

Graduate data collection took place between May and November of 1993, with computer-assisted telephone interviewing as the primary means of data collection. Flyers were sent to all graduates announcing the study and asking for phone numbers at which they could be reached during the survey period. Extensive tracing of graduates was required to obtain the desired response rate. Tracing activities included computerized telephone number searches, national change of address searches (NCOA), school alumni office contacts, school major field department contacts, directory assistance, military locators, post office records, personal referrals from parents or others who know the graduate, and the use of professional tracing organizations.

Table A-2 gives the response rates by cohort, degree, major, sex, and type of address. The overall unweighted graduate response rate is 86 percent. The weighted response rate is 84 percent. The weighted overall or second-stage response rate is calculated as the school response rate times the graduate response rate (.994 x .841 = .836). As can be seen from table A-2, response rates varied somewhat by major field of study and by sex. Rates were lowest for those with foreign addresses.

Weight Calculations

To produce national estimates, the data were weighted. Weighting the data adjusted for unequal selection probabilities and for nonresponse at the institution and graduate level. In addition, a ratio adjustment was made at the institution level using the number of graduates reported in specified IPEDS categories of major and degree. The final adjustment to the graduate weights adjusted for those responding graduates who could have been sampled twice. For example, a person who obtained an eligible bachelor’s degree in 1990 could have obtained an eligible master’s degree in 1992 and could have been sampled for either degree. To make the estimates from the survey essentially unbiased, we modified the weights of all responding graduates who could have been sampled twice. The weights of these graduates were divided by 2.

Table A-2. Number of sampled graduates, unweighted graduate response rates, weighted graduate response rates, weighted list collection response rates, and overall response rates, by graduate characteristics: 1993

Graduate characteristic	Number of sampled graduates by status				Unweighted graduate response rate[2]	Weighted response rates		
	Total	Response		Non-response		Graduate response rate	List collection response rate[3]	Overall response rate[4]
		Complete	Ineligible[1]					
Total	25,785	19,426	2,670	3,689	85.7%	84.1%	99.4%	83.6%
Graduation cohort								
Spring 1990	7,324	5,513	730	1,081	85.2%	83.6%	98.5%	82.3%
1990-91	9,648	7,127	1,114	1,407	85.4%	84.0%	99.9%	83.9%
1991-92	8,813	6,786	826	1,201	86.4%	84.5%	99.8%	84.4%
Sampled degree[5]								
Bachelor's	16,585	12,812	1,455	2,318	86.0%	84.1%	99.4%	83.6%
Master's	9,200	6,614	1,215	1,371	85.1%	84.0%	99.4%	83.5%
Sampled degree major[5]								
Physical and environmental sciences	4,766	3,760	484	522	89.0%	89.0%	99.4%	88.5%
Mathematics/statistics	1,301	987	144	170	86.9%	87.3%	99.4%	86.8%
Computer sciences	1,298	915	121	262	79.8%	79.5%	99.4%	79.1%
Engineering	9,591	7,579	728	1,284	86.6%	85.2%	99.4%	84.7%
Biological sciences	1,407	1,138	86	183	87.0%	87.6%	99.4%	87.1%
Agricultural sciences	952	705	137	110	88.4%	89.7%	99.4%	89.2%
Psychology	1,695	1,299	95	301	82.2%	82.3%	99.4%	81.8%
Economics	1,313	867	173	273	79.2%	79.6%	99.4%	79.1%
Other social sciences	2,730	1,964	313	453	83.4%	83.1%	99.4%	82.6%
Unknown major	732	212	389	131	82.1%	82.1%	99.4%	81.6%
Type of address provided by school at the time of sampling[6]								
U.S. address only	23,711	18,431	2,181	3,099	86.9%	85.2%	99.4%	84.7%
Foreign address	937	294	372	271	71.1%	65.8%	99.4%	65.4%
No address	1,137	701	117	319	71.9%	63.9%	99.4%	63.5%
Sex of graduate[7]								
Male	17,043	12,870	1,675	2,498	85.3%	83.3%	99.4%	82.8%
Female	8,742	6,556	995	1,191	86.4%	85.2%	99.4%	84.7%

[1]The 2,670 ineligibles include the following: graduates living out of the U.S. during the week of April 15, 1993 (1,135), graduates who reported an ineligible major field for their sampled degrees (841), those who did not receive a bachelor's or master's degree from the sampled school within the correct time frame (617), duplicates (50), deceased (26), and over the age of 75 in April 1993 (1).

[2]The graduate response rate is calculated as (R - I) / [(R - I) + (N * p)] where R = Responses (completed plus ineligible), I = Ineligible, N = Nonresponse, and p = Proportion of response found in scope calculated as (R - I)/R.

[3]The list collection response rate is calculated as Completed/ (Total-Ineligible).

[4]The overall response rate is calculated by multiplying the graduate response rate by the list collection response rate.

[5]The degree and major codes are those reported by institutions at the time of sampling and may not match data reported by the respondents on the survey.

[6]This reflects the type of address provided by the institution at the time of sampling. Additional address information may have been provided by the alumni office during data collection. Graduates from whom both a U.S. and a foreign address were provided are included in the foreign address category.

[7]Sex codes were obtained from four sources: those reported on the survey, the title field (i.e., Mr., Ms.) on the sample file, coded from first name, and imputation. Imputation was done on 250 nonrespondents where sex could not be coded from the name.

SOURCE: National Science Foundation, 1993 National Survey of Recent College Graduates.

The weights developed for the NSRCG:93 comprise both full-sample weights for use in computing survey estimates and replicate weights for use on variance estimation with a jackknife replication variance estimation procedure.

Data Editing

Most editing checks were included within the CATI system, including range checks, skip pattern rules, and logical consistency checks. Skip patterns were controlled by the CATI system so that inappropriate items were avoided. For logical consistency check violations, CATI screens appeared that explained the discrepancy and asked the respondent for corrections. Some additional logical consistency checks were added during data preparation, and all edit checks were rerun after item nonresponse imputation.

Imputation of Missing Data

Missing data occur if the respondent cooperated with the survey but did not answer one or more individual questions. The item nonresponse for this study was very low (typically about 1 percent) as a result of using CATI for data collection and data retrieval techniques for missing key items. However, imputation for item nonresponse was performed for each survey item to make the study results simpler to present and to allow consistent totals to be obtained when analyzing different questionnaire items. "Not applicable" responses were not imputed since these represented respondents who were not eligible to answer the relevant item.

Imputation was performed using a hot-deck method. Hot-deck methods estimate the missing value of an item by using values of the same item from other record(s) in the same file. Using the hot-deck procedure, each missing questionnaire item was imputed separately. First, respondent records were sorted by items thought to be related to the missing item. Next, a value was imputed for each item nonresponse recipient from a respondent donor within the same subgroup. The results of the imputation procedure were reviewed to ensure that the plan had been followed correctly. In addition, all edit checks were run on the imputed file to be sure that no data inconsistencies were created by imputation.

For a more detailed discussion of survey methodology, readers are referred to the NSRCG: 93 data file User's Manual.

Accuracy of Estimates

The survey estimates provided in these tables are subject to two sources of error: sampling and nonsampling errors. Sampling errors occur because the estimates are based on a sample of individuals in the population rather than on the entire population and hence are subject to sampling variability. If the interviews had been conducted with a different sample, the responses would not have been identical; some figures might have been higher, whereas others might have been lower.[1]

The standard error is the measure of the variability of the estimates arising from sampling. It indicates the variability of a sample estimate that would be obtained from all possible samples of a given design and size. Standard errors can be used as a measure of the precision expected from a particular sample. Tables A-3 to A-6 contain standard errors for key statistics included in the detailed tables.

[1] A detailed discussion of nonsampling errors can be found at the end of this section starting on page 20.

Table A-3. Unweighted number, weighted estimate, and standard errors for 1991 science and engineering bachelor's degree recipients, by graduate characteristics: April 1993

Characteristic	Unweighted number	Weighted estimate			
		Weighted number	Standard error	Weighted percent	Standard error
Total 1991 science and engineering bachelor's degree recipients	4,857	308,500	8,400	100%	
Sex					
Male	3,180	170,900	6,100	55	1.10
Female	1,677	137,600	4,700	45	1.10
Race/ethnicity					
American Indian/Alaskan Native	11	1,000	400	*	0.14
Asian/Pacific Islander	384	23,100	2,000	8	0.60
Black, non-Hispanic	284	20,200	3,700	7	1.13
Hispanic	258	16,400	2,200	5	0.70
White, non-Hispanic	3,920	247,800	7,600	80	1.68
Type of major field					
Science	2,950	247,900	7,600	80	0.88
Engineering	1,907	60,600	2,900	20	0.88
Major field of study					
Computer and mathematical sciences	458	37,800	1,900	12	0.56
Life and related sciences	728	47,600	1,800	15	0.53
Physical and related sciences	683	16,200	600	5	0.23
Social and related sciences	1,081	146,300	6,200	47	1.06
Engineering	1,907	60,600	2,900	20	0.88
Occupation (total employed)	4,192	260,700	7,600	100	
Computer and mathematical scientists	278	20,700	1,400	8	0.54
Life and related scientists	139	9,400	900	4	0.36
Physical scientists	327	9,700	700	4	0.24
Social and related scientists	86	10,500	1,300	4	0.47
Engineers	1,356	41,500	1,900	16	0.70
Other occupations	2,006	169,000	6,500	65	1.01

* = Less than 0.5%

NOTE: Represents graduates from July 1990 through June 1991. Details may not add to totals because of rounding.

SOURCE: National Science Foundation, *National Survey of Recent College Graduates, 1993*

Table A-4. Unweighted number, weighted estimate, and standard errors of 1991 science and engineering master's degree recipients, by graduate characteristics: April 1993

Characteristic	Unweighted number	Weighted estimate			
		Weighted number	Standard error	Weighted percent	Standard error
Total 1991 science and engineering master's degree recipients	2,458	57,000	1,900	100%	
Sex					
Male	1,695	38,700	1,300	68	1.25
Female	763	18,300	1,000	32	1.25
Race/ethnicity					
American Indian/Alaskan Native	8	200	100	*	0.12
Asian/Pacific Islander	483	11,100	700	19	1.33
Black, non-Hispanic	84	2,500	500	4	0.82
Hispanic	94	2,000	200	4	0.38
White, non-Hispanic	1,789	41,200	1,900	72	1.45
Type of major field					
Science	1,438	36,900	1,900	65	1.30
Engineering	1,020	20,100	400	35	1.30
Major field of study					
Computer and mathematical sciences	267	13,000	1,500	23	1.94
Life and related sciences	312	6,900	400	12	0.51
Physical and related sciences	428	5,200	300	9	0.55
Social and related sciences	431	11,800	600	21	0.89
Engineering	1,020	20,100	400	35	1.30
Occupation (total employed)	2,202	51,700	1,800	100	
Computer and mathematical scientists	229	9,800	1,300	19	1.98
Life and related scientists	157	3,400	300	7	0.56
Physical scientists	316	4,000	300	8	0.56
Social and related scientists	187	4,900	400	9	0.82
Engineers	762	14,500	500	28	1.11
Other occupations	551	15,100	700	29	1.21

* = Less than 0.5%.

NOTE: Represents graduates from July 1990 through June 1991. Details may not add to totals because of rounding.

SOURCE: National Science Foundation, *National Survey of Recent College Graduates, 1993*

Table A-5. Unweighted number, weighted estimate, and standard errors for 1992 science and engineering bachelor's degree recipients, by graduate characteristics: April 1993

Characteristic	Unweighted number	Weighted estimate			
		Weighted number	Standard error	Weighted percent	Standard error
Total 1992 science and engineering bachelor's degree recipients	4,550	330,900	8,500	100%	
Sex					
Male	2,968	184,000	5,100	56	1.06
Female	1,582	146,900	5,800	44	1.06
Race/ethnicity					
American Indian/Alaskan Native	14	900	300	*	0.10
Asian/Pacific Islander	371	25,400	2,200	8	0.70
Black, non-Hispanic	277	23,900	4,100	7	1.20
Hispanic	208	13,800	1,500	4	0.50
White, non-Hispanic	3,680	266,900	7,600	81	1.60
Type of major field					
Science	2,889	273,200	7,900	83	0.40
Engineering	1,661	57,700	1,200	17	0.40
Major field of study					
Computer and mathematical sciences	452	39,800	1,900	12	0.50
Life and related sciences	692	52,100	2,600	16	0.82
Physical and related sciences	616	17,500	1,200	5	0.30
Social and related sciences	1,129	163,700	6,600	49	1.07
Engineering	1,661	57,700	1,200	17	0.40
Occupation (total employed)	3,912	279,700	7,700	100	
Computer and mathematical scientists	277	22,700	2,000	8	0.63
Life and related scientists	136	9,400	900	3	0.34
Physical scientists	282	9,400	800	3	0.23
Social and related scientists	74	10,300	1,400	4	0.47
Engineers	1,027	35,200	1,100	13	0.47
Other occupations	2,116	192,600	6,300	69	0.91

* = Less than 0.5.%.

NOTE: Represents graduates from July 1991 through June 1992. Details may not add to totals because of rounding.

SOURCE: National Science Foundation, *National Survey of Recent College Graduates, 1993*

Table A-6. Unweighted number, weighted estimate, and standard errors for 1992 science and engineering master's degree recipients, by graduate characteristics: April 1993

Characteristic	Unweighted number	Weighted estimate			
		Weighted number	Standard error	Weighted percent	Standard error
Total 1992 science and engineering master's degree recipients	2,509	58,600	1,600	100%	
Sex					
Male	1,705	37,900	1,200	65	1.08
Female	804	20,700	800	35	1.08
Race/ethnicity					
American Indian/Alaskan Native	7	200	100	*	0.12
Asian/Pacific Islander	542	13,100	700	22	1.18
Black, non-Hispanic	91	2,200	400	4	0.58
Hispanic	86	1,800	200	3	0.30
White, non-Hispanic	1,783	41,500	1,400	71	1.31
Type of major field					
Science	1,377	37,700	1,400	64	1.00
Engineering	1,132	20,900	600	36	1.00
Major field of study					
Computer and mathematical sciences	259	11,100	500	19	0.74
Life and related sciences	286	6,300	300	11	0.50
Physical and related sciences	387	5,400	400	9	0.48
Social and related sciences	445	14,900	800	25	1.04
Engineering	1,132	20,900	600	36	1.01
Occupation (total employed)	2,195	51,400	1,400	100	
Computer and mathematical scientists	237	8,200	500	16	1.02
Life and related scientists	145	3,300	300	6	0.54
Physical scientists	289	4,100	300	8	0.64
Social and related scientists	158	4,800	400	9	0.77
Engineers	803	15,100	600	29	1.04
Other occupations	563	15,900	800	31	1.27

* = Less than 0.5%.

NOTE: Represents graduates from July 1991 through June 1992. Details may not add to totals because of rounding.

SOURCE: National Science Foundation, *National Survey of Recent College Graduates, 1993*

Table A-7. Estimated parameters for computing generalized variances for estimates from the NSRCG: 93

Domain	Bachelor's recipients parameter estimates			Master's recipients parameter estimates		
	a [1]	b [1]	DEFF [2]	a [1]	b [1]	DEFF [2]
1991 graduates						
All graduates	0.000116	132.515	1.9	0.013208	11.064	1.6
Sex						
Male	0.001079	94.871	2.2	0.000354	38.915	1.8
Female	-0.000010	178.568	2.6	0.001214	37.876	1.8
Major						
Science majors	0.000411	178.903	2.8	0.002822	26.086	2.0
Engineering majors	0.000818	80.969	1.6	-0.001952	41.629	1.7
Occupation						
Scientists	-0.000872	131.591	1.8	0.003328	27.255	2.0
Engineers	-0.000045	82.807	1.2	-0.000006	27.478	1.4
Other occupations	0.000451	195.981	2.6	-0.000500	41.688	1.7
Race/ethnicity						
White, non-Hispanic	0.000718	120.830	3.6	0.001287	37.517	2.2
Black, non-Hispanic	0.032007	81.327	5.6	0.019705	43.892	2.9
Hispanic	0.006942	141.348	3.3	0.000230	26.526	1.2
Asian/Pacific Islanders	0.001170	124.246	2.2	0.002644	33.742	2.3
1992 graduates						
All graduates	0.006530	68.747	1.8	0.014906	9.977	1.4
Sex						
Male	0.000731	83.675	1.8	-0.000229	42.863	1.6
Female	0.000494	166.358	2.1	-0.000665	42.195	1.5
Major						
Science majors	0.000566	150.333	2.0	-0.001252	68.013	1.8
Engineering majors	-0.000971	72.909	0.7	-0.000408	28.939	1.2
Occupation						
Scientists	-0.000565	171.386	1.9	-0.000062	39.428	1.6
Engineers	-0.001254	73.203	0.8	0.000029	27.230	1.2
Other occupations	0.000117	188.939	1.9	0.000463	41.454	1.7
Race/ethnicity						
White, non-Hispanic	0.000746	88.749	2.9	-0.000806	55.473	1.9
Black, non-Hispanic	0.026867	128.155	5.7	0.015080	32.573	2.0
Hispanic	0.006141	121.118	2.2	-0.001975	25.648	1.0
Asian/Pacific Islanders	0.004119	106.541	2.2	0.001693	29.712	1.8

[1]/ See discussion of "Estimated Totals" on page 17 of the text.

[2]/ DEFF = design effect.

SOURCE: National Science Foundation, *National Survey of Recent College Graduates, 1993*

If all possible samples were surveyed under similar conditions, intervals within plus or minus 1.96 standard errors of a particular statistic would include the true population parameter being estimated in about 95 percent of the samples. This is the 95-percent confidence interval. For example, the total number of 1991 bachelor's degree recipients majoring in engineering is 60,600 and the estimated standard error is 2,900. The 95 percent confidence interval for the statistic extends from

60,600 - (2,900 x 1.96) to 60,660 + (2,900x 1.96) = 54,916 to 66,284.

This means that one can be confident that intervals constructed in this way contain the true population parameter 95 percent of the time.

Estimates of standard errors were computed using a technique known as a jackknife replication. As with any replication method, jackknife replication involves constructing a number of subsamples (replicates) from the full sample and computing the statistics of interest for each replicate. The mean square error of the replicate estimates around their corresponding full sample estimate provides an estimate of the sampling variance of the statistic of interest. To construct the replications, 50 stratified subsamples of the full sample were created. Fifty jackknife replicates were then formed by deleting one subsample at a time from the full sample. WesVarPC, a public use computer program developed at Westat, was used to calculate direct estimates of standard errors for a number of statistics from the survey.

Generalized Variance Functions

Computing and printing standard errors for each estimate from the survey is a time-consuming and costly effort. For this survey, a different approach was taken for estimating the standard errors of the estimates reported in this report. First, the standard errors for a large number of different estimates were directly computed using the jackknife replication procedures described above. Next, models were fitted to the estimates and standard errors and the parameters of these models were estimated from the direct estimates. These models and their estimated parameters can now be used to approximate the standard error of an estimate from the survey. This process is called the development of generalized variance functions. Models were fitted for the two types of estimates of primary interest: estimated totals and estimated percentages.

It should be noted that the models used to estimate the generalized variance functions may not be completely appropriate for all estimates. When it is feasible, direct estimates of the standard errors should be computed using the replication method. This process is relatively simple since replicate weights and software such as WesVarPC are available.

Estimated Totals

For estimated totals, the generalized variance function applied assumes that the relative variance of the estimate (the square of the standard error divided by the square of the estimate) is a linear function of the inverse of the estimate. Using this model, the standard error of an estimate can be computed as

$$se(y) = \sqrt{ay^2 + by} \qquad (1)$$

where se(y) is the standard error of the estimate y, and a and b are estimated parameters of the model. The parameters of the models were computed separately for 1991 bachelor's and master's recipients and for 1992 bachelor's and master's recipients, as well as for other important domains of interest. The estimates of the parameters are given in Table A-7.

The following steps should be followed to approximate the standard error of an estimated total:

1) obtain the estimated total from the survey,

2) determine the most appropriate domain for the estimate from Table A-7,

3) refer to Table A-7 to get the estimates of a and b for this domain, and

4) compute the generalized variance using equation (1) above.

For example, suppose that the number of 1991 bachelor's degree recipients in engineering who were currently working in an engineering-related job was 40,000 (y = 40,000). The most appropriate domain

from Table A-7 is engineering majors with bachelor's degrees from 1991 and the parameters are a = 0.000818 and b = 80.969. Approximate the standard error using equation (1) as

$$se(40{,}000) = \sqrt{.000818(40{,}000)^2 + 80.969(40{,}000)} = 2{,}133$$

ESTIMATED PERCENTAGES

The model used to approximate the standard errors for estimates of percentages was somewhat less complex than the model to estimate totals. The generalized variance for estimated percentages assumed that the ratio of the variance of an estimate to the variance of the same estimate from a simple random sample of the same size was a constant. This ratio is called the design effect and is often labeled the DEFF. Since the variance for an estimated percentage, p, from a simple random sample is $p(100\text{-}p)$ divided by the sample size, the standard error of an estimated percentage can be written as

$$se(p) = \sqrt{DEFF(p)(100\text{-}p) / n} \qquad (2)$$

where n is the sample size or denominator of the estimated percentage. DEFFs were computed separately for 1991 bachelor's and master's recipients and for 1992 bachelor's and master's recipients, as well as for other important domains of interest. The median or average value of the DEFFs from these computations are given in Table A-7.

The following steps should be followed to approximate the standard error of an estimated percentage:

1) obtain the estimated percentage and sample size from the survey,

2) determine the most appropriate domain for the estimate from Table A-7,

3) refer to Table A-7 to get the estimates of the DEFF for this domain, and

4) compute the generalized variance using equation (2) above.

For example, suppose that the percentage of 1991 bachelor's degree recipients in engineering who were currently working in an engineering-related job was 60 percent (p = 60) and the number of engineering majors from the survey was 1,907. The most appropriate domain from Table A-7 is engineering majors with bachelor's degrees from 1991 and the DEFF for this domain is 1.6. Approximate the standard error using equation (2) as

$$se(60\%) = \sqrt{1.6(60)(100 - 60) / 1907} = 1.4\%$$

NONSAMPLING ERRORS

In addition to sampling errors, the survey estimates are subject to nonsampling errors that can arise because of nonobservation (nonresponse or noncoverage), reporting errors, and errors made in the collection and processing of the data. These errors can sometimes bias the data. The NSRCG:93 included procedures for both minimizing and measuring nonsampling errors.

Procedures to minimize nonsampling errors were followed throughout the survey. Extensive questionnaire design work was done by Mathematica Policy Research (MPR), NSF, and Westat. This work included focus groups, expert panel reviews, and a mail and CATI pretest. The design work was done in conjunction with the other two SESTAT surveys.

Strict training and monitoring of interviewers and data processing staff were conducted to help ensure the consistency and accuracy of the data file. Data collection was done almost entirely by telephone to help reduce the amount of item nonresponse and item inconsistency. Mail questionnaires were used for cases difficult to complete by telephone. Nonresponse was handled in ways designed to minimize the impact on data quality (through weighting adjustments and imputation). In data preparation a special effort was made in the area of occupational coding. All respondent-chosen codes were verified by data preparation staff using a variety of information collected on the survey and applying coding rules developed by NSF for the SESTAT system.

Although general sampling theory can be used to estimate the sampling variability of a statistic, the measurement of nonsampling error is not easy and usually requires that an experiment be conducted as part of the data collection, or that data external to the study be used. For NSRCG:93, two data quality studies were completed: (1) an analysis of interviewer variance, and (2) a behavioral coding analysis of 100 recorded interviews. The interviewer variance study was designed to measure how interviewer effects might have affected the precision of the estimates. The results showed that interviewer effects for most items were minimal and thus had a very limited effect on the standard error of the estimates. Interviewer variance was highest for open-ended questions.

The behavioral coding study was done to observe the extent to which interviewers were following the structured interview and the extent to which it became necessary for them to give unstructured additional explanation or comment to respondents. As part of the study, 100 interviews were taped and then coded on a variety of behavioral dimensions. This analysis revealed that on the whole the interview proceeded in a very structured manner with 85 percent of all questions and answers being "asked and answered only." Additional unstructured interaction/discussion took place most frequently for those questions in which there was some ambiguity in the topic. In most cases this interaction was judged to have facilitated obtaining the correct response.

Both the recorded interview and the variance study were used to identify those questionnaire items that might need additional revision for the next (1995) study cycle. A debriefing session concerning the survey was held with interviewers, and this information was also used in revising the survey for the 1995 cycle. In addition, results from a reinterview conducted by the Census Bureau for the NSCG were reviewed in this regard.

Comparisons of Data with Previous Years' Results

A word of caution needs to be given concerning comparisons with previous NSRCG results. For 1993, the SESTAT system underwent considerable revision in all areas, including survey eligibility, data collection procedures, questionnaire content and wording, and data coding and editing procedures.

Among the important changes for 1993 that may affect comparisons with previous years' survey results are the following:

- **The exclusion from eligibility of those living in foreign countries during the reference week.** For NSRCG:93 and the other SESTAT 1993 surveys, those who were living outside the United States on the reference date for the survey (April 15, 1993) were not considered eligible for the study. This was not the case in previous NSRCG cycles.

- **Changes in the major fields represented.** Certain majors included in previous cycles were not included in this NSRCG cycle. For example, among the majors eligible in 1990 but not included in 1993 were computer programming (computer science was, however, eligible), actuarial science, engineering technologies, farm management, horticulture operations/management, business-related information systems/services, operations research, science education, math education, social science education, engineering education, criminal justice, city and regional planning, and conservation, natural resources, wildlife management, and forestry production. Appendix A presents a listing of eligible and ineligible majors for 1993 with a cross-reference to the Department of Education's standard Classification of Instructional Programs (CIP).

- **Higher response rates and the CATI data collection method.** The higher response rates obtained in 1993 may result in some change in estimates for certain statistics. Previous data collections have had response rates of 65-73 percent. It may be that those responding may have been more likely to be employed and to be employed in science and engineering. Previous studies were primarily mail with telephone followup. Mode effects may cause differences for some questions.

- **Changes in the salary question.** In previous cycles, annual or academic-year income was requested. In 1993, the respondent was given the choice to answer in hours, weeks, months, years,

or academic years. Annual income was then calculated for all respondents. There was also a difference in the way academic-year salaries were handled. In the 1990 survey, academic-year salaries were inflated (multiplied by 11/9). In the 1993 cycle, the academic-year salaries were left as reported. Because of data quality issues for the self-employed for the entire SESTAT system, full-time salary data included in this report exclude those for the self-employed. Those reporting they were full-time students on the reference date were also excluded from salary data reported for NSRCG.

- **The development for 1993 of separate systems of classification for occupation and major field of study.** In previous NSRCG study years, the major and job (employment) lists were combined, and each was somewhat less specific than in 1993. For the 1993 survey, the major field list was made more comparable with the Department of Education's CIP, and the occupation list was made more comparable with the Standard Occupational Classification (SOC) codes. Thus, the NSRCG data on the number and percent working in science and engineering occupations are not comparable with previous years' results. Exhibits 1 to 4 display listings of the major and job category lists used in the survey and the summary classifications used in the tables.

- **The development of standard SESTAT coding and classification rules with regard to occupations such as managers, teachers, computer occupations, and other occupations.** For NSRCG: 93 certain SESTAT rules were followed in assigning a best code for occupations. These rules, combined with the new occupational coding list, resulted in fewer persons being categorized as employed in science and engineering occupations. For example, those that supervised more than five persons through subordinate supervisors were usually classified as top- or mid-level managers. Those who reported computer programming as their occupation were grouped with technicians in summary occupation tables. Many of these individuals would have been classified as scientists or engineers in the previous cycles in which the major field and employment field lists were combined.

Comparisons with U.S. Department of Education Data

In weighting the NSRCG: 93 data, ratio adjustments were made at the institution level to Integrated Postsecondary Educational Data System (IPEDS) estimates. However, because of the special NSF eligibility requirements and use of differing summary classification systems, the estimates given in these sets of tables do not correspond directly to tables reported for IPEDS. There are two major reasons for these differences: (1) the exclusions from the NSRCG of certain groups, primarily those living outside of the United States on the reference date and those over 75 years of age; and (2) the exclusion from the NSRCG sample of certain majors. It should also be noted that IPEDS is based on administrative records and NSRCG on respondent classification.

Other Explanatory Information

Coverage of tables. In this report's tables information is presented for the 1991 and 1992 bachelor's and master's degree cohorts (academic years 1990-91 and 1991-92). Information for the 1990 cohort was collected primarily for inclusion in the SESTAT longitudinal studies and hence did not cover an entire year, but only that part of the cohort not represented in the 1990 decennial census (those graduating from April 1990 to June 1990).

The following definitions are provided to facilitate the reader's use of the data in this report.

Major field of study: Derived from the survey major field category most closely related to the respondent's degree field. Exhibit 1 is a listing of the detailed major field codes used in the survey. Exhibit 2 is a listing of the summary major field codes developed by NSF and used in the tables. A listing of the eligible and ineligible major fields within each summary category appears in the appendix.

Occupation: Derived from the survey job list category most closely related to the respondent's primary job. Exhibit 3 is a listing of the detailed job codes used in the survey, and Exhibit 4 is a summary of the occupation codes developed by NSF and used in the tables.

Labor force: The labor force includes individuals working full or part time as well as those not working but seeking work or on layoff. It is a sum of the employed and the unemployed.

Unemployed: The unemployed are those who were not working on April 15 and were seeking work or on layoff from a job.

Involuntarily out of field: Those respondents who are involuntarily out of field either: (1) have a job not related to degree field and have indicated they took a job because suitable work in a degree field was not available, or (2) are employed part time and took part-time work only because suitable full-time work was not available.

Type of employer: This is the sector of employment in which the respondent was working on his or her primary job on April 15, 1993. In this categorization, those working in 4-year colleges and universities or university-affiliated medical schools or research organizations were classified as employed in the "4-year college and university" sector. Those working in elementary, middle, secondary, or 2-year colleges or other educational institutions were categorized in the group "other educational." The other sectors are private, for profit, self-employed, nonprofit organizations, federal government, and state or local government. Those reporting that they were self-employed but in an incorporated business were classified in the private, for-profit sector.

Primary and secondary work activities: These refer to activities that occupied the most time and the second-most time on the respondent's job. In reporting the data, those who reported applied research, basic research, development, or design work were grouped together in "research and development (R&D)." Those who reported teaching were given the code "teaching." Those who reported accounting, finance or contracts, employee relations, quality or productivity management, sales and marketing, or management or administration were grouped into "management, sales, administration." Those who reported computer applications were placed in "computer applications." Those who reported production, operation maintenance, or professional services or other activities were given the code "other."

Full-time salary: This is the annual income for the full-time employed who were not self-employed and who were not full-time students on the reference date (April 15, 1993). To annualize salary, reported hourly salaries were multiplied by 2080, reported weekly salaries were multiplied by 52, and reported monthly salaries were multiplied by 12. Yearly and academic-yearly salaries were left as reported.

Exhibit 1

LIST A. EDUCATION CODES

This EDUCATION CODES list is ordered alphabetically. The titles in bold type are broad fields of study. To make sure you have found the BEST code, please review ALL broad categories before making your choice. If you cannot find the code that BEST describes your field of study, use the "OTHER" code under the most appropriate broad field in bold print. If none of the codes fit your field of study, use Code 995.

Agriculture Business and Production
601 Agriculture, economics (also see 655 and 923)
602 OTHER, agricultural business and production

Agricultural Sciences
605 Animal sciences
606 Food sciences and technology (also see 638)
607 Plant sciences (also see 633)
608 OTHER, agricultural sciences

610 **Architecture/Environmental Design**
(for architectural engineering, see 723)

620 **Area/Ethnic Studies**

Biological/Life Sciences
631 Biochemistry and biophysics
632 Biology, general
633 Botany (also see 607)
634 Cell and molecular biology
635 Ecology
636 Genetics, animal and plant
637 Microbiology
638 Nutritional sciences (also see 606)
639 Pharmacology, human and animal (also see 788)
640 Physiology, human and animal
641 Zoology, general
642 OTHER, biological sciences

Business Management/Administrative Services
651 Accounting
652 Actuarial science
653 Business administration and management
654 Business, general
655 Business/managerial economics (also see 601 and 923)
656 Business marketing/marketing mgmt.
657 Financial management
658 Marketing research
843 Operations research
659 OTHER, business management/admin. services

Communications
661 Communications, general
662 Journalism
663 OTHER, communications

Computer and Information Sciences
671 Computer/information sciences, general
672 Computer programming
673 Computer science (also see 727)
674 Computer systems analysis
675 Data processing technology
676 Information services and systems
677 OTHER, computer and information sciences

Conservation/Renewable Natural Resources
680 Environmental science studies
681 Forestry sciences
682 OTHER, conservation/renewable natural resources

690 **Criminal Justice/Protective Services**
(also see 922)

Education
701 Administration
702 Computer teacher education
703 Counselor education/guidance services
704 Educational psychology
705 Elementary teacher education
706 Mathematics teacher education
707 Physical education/coaching
708 Pre-elementary teacher education

Exhibit 1 (continued)

LIST A. EDUCATION CODES (CONTINUED)

709 Science teacher education
710 Secondary teacher education
711 Special education
712 Social science teacher education
713 OTHER, education

Engineering

721 Aerospace, aeronautical, astronautical
722 Agricultural
723 Architectural
724 Bioengineering and biomedical
725 Chemical
726 Civil
727 Computer/systems (also see 673)
728 Electrical, electronics, communications (also see 751)
729 Engineering sciences, mechanics, physics
730 Environmental
731 General
732 Geophysical
733 Industrial (also see 752)
734 Materials, including ceramics and textiles
735 Mechanical (also see 753)
736 Metallurgical
737 Mining and minerals
738 Naval architecture and marine
739 Nuclear
740 Petroleum
741 OTHER, engineering

Engineering-Related Technologies

751 Electrical and electronic technologies
752 Industrial production technologies
753 Mechanical engineering-related technologies
754 OTHER, engineering-related technologies

760 **English Language and Literature/Letters**
(for Linguistics, see 771)

Foreign Languages and Literature

771 Linguistics
772 OTHER, foreign languages and literature

Health Professions and Related Sciences

781 Audiology and speech pathology
782 Health services administration
783 Health/medical assistants
784 Health/medical technologies
785 Medical preparatory programs (e.g., pre-dentistry, pre-medical, pre-veterinary)
786 Medicine (e.g., dentistry, optometry, osteopathic, podiatry, veterinary)
787 Nursing (4 years or longer program)
788 Pharmacy (also see 639)
789 Physical therapy and other rehabilitation/ therapeutic services
790 Public health (including environmental health and epidemiology)
791 OTHER, health/medical sciences

800 **Home Economics**

810 **Law/Prelaw/Legal Studies**

820 **Liberal Arts/General Studies**

830 **Library Science**

Mathematics

841 Applied (also see 843, 652)
842 Mathematics, general
843 Operations research
844 Statistics
845 OTHER, mathematics

850 **Parks, Recreation, Leisure, and Fitness Studies**

Philosophy, Religion, and Theology

861 Philosophy of science
862 OTHER, philosophy, religion, theology

Physical Sciences

871 Astronomy and astrophysics
872 Atmospheric sciences and meteorology
631 Biochemistry and biophysics
873 Chemistry
874 Earth sciences

Exhibit 1 (continued)

LIST A. EDUCATION CODES (CONTINUED)

680 Environmental science studies
875 Geology
876 Geological sciences, other
877 Oceanography
878 Physics
879 OTHER, physical sciences

Psychology

891 Clinical
892 Counseling
704 Educational
893 Experimental
894 General
895 Industrial/Organizational
896 Social
897 OTHER, psychology

Public Affairs

901 Public administration
902 Public policy studies
903 OTHER, public affairs

910 Social Work

Social Sciences and History

921 Anthropology and archeology
922 Criminology (also see 690)
923 Economics (also see 601 and 655)
924 Geography
925 History of science
926 History, other
927 International relations
928 Political science and government
929 Sociology
930 OTHER, social sciences

Visual and Performing Arts

941 Dramatic arts
942 Fine arts, all fields
943 Music, all fields
944 OTHER, visual and performing arts

991 **Other science/engineering**
995 **Other Fields - Not Listed**

Exhibit 2.

MAJOR CODE CATEGORIES FOR TABULATIONS

1. Computer and mathematical sciences

11 Computer and information sciences 671, 673, 674, 676, 677
12 Mathematical sciences 841-845

2. Life and related sciences

21 Agricultural and food sciences 605-608
22 Biological sciences 631-642, (781-791 Ph.D. degree only-eligible for SDR survey only, not NSRCG), 991
23 Environmental life sciences including forestry sciences 680, 681

3. Physical and related sciences

31 Chemistry 873
32 Earth sciences, geology, oceanography 872, 874-877
33 Physics and astronomy 871, 878
34 Other physical sciences 879

4. Social sciences and related sciences

41 Economics 601, 923
42 Political and related sciences 902, 927, 928
43 Psychology 704*, 891*, 892-897,
44 Sociology and anthropology 921, 922*, 929
45 Other social sciences 620*,771, 861, 924, 925, 930

5. Engineering

51 Aerospace and related engineering 721
52 Chemical engineering 725
53 Civil and related engineering 723, 726
54 Electrical, electronic, computer, and communications engineering 727, 728
55 Industrial engineering 733
56 Mechanical engineering 735
57 Other engineering 722, 724, 729-732, 734, 736-741

6. 60 Other majors

602, 610, 651-659, 661-663, 672, 675, 682, 690, 701-703, 705-713, 751-754, 760, 772, 781-791^{x}, 800, 810, 820, 830, 850, 862, 901, 903, 910, 926, 941-944, 995

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* The categories area and ethnic studies (620), educational psychology (704), clinical psychology (891), school psychology (part of 897), archeology (part of 921), and criminology (922), were not sampled for the 1993 NSRCG.

x At the BA, MA, or professional level

SOURCE: National Science Foundation, *1993 National Survey of Recent College Graduates*

Exhibit 3.

LIST B. JOB CODES

This JOB CODES list is ordered alphabetically. The titles in bold type are broad job categories. To make sure you have found the BEST code, please review ALL broad categories before making your choice. If you cannot find the code that BEST describes your job, use the "OTHER" code under the most appropriate broad category in bold print. If none of the codes fit your job, use Code 500.

010 **Artists, Broadcasters, Editors, Entertainers, Public Relations Specialists, Writers**

Biological/Life Scientists
021 Agricultural and food scientists
022 Biochemists and biophysicists
023 Biological scientists (e.g., botanists, ecologists, zoologists)
024 Forestry, conservation scientists
025 Medical scientists (excluding practitioners)
026 Technologists & technicians in the biological/life sciences
027 OTHER biological/life scientists

Clerical/Administrative Support
031 Accounting clerks, bookkeepers
032 Secretaries, receptionists, typists
033 OTHER administrative (e.g., record clerks, telephone operators)

040 **Clergy & Other Religious Workers**

Computer Occupations (Also see 173)
*** Computer engineers (See 087, 088 under Engineering)
051 Computer programmers (business, scientific, process control)
052 Computer system analysts
053 Computer scientists, except system analysts
054 Information systems scientists or analysts
055 OTHER computer, information science occupations

*** **Consultants** (select the code that comes closest to your usual area of consulting)

070 Counselors, Educational & Vocational (Also see 236)

Engineers, Architects, Surveyors
081 Architects

*** Engineers (Also see 100-103)
082 Aeronautical, aerospace, astronautical
083 Agricultural
084 Bioengineering & biomedical
085 Chemical
086 Civil, including architectural & sanitary
087 Computer engineer - hardware
088 Computer engineer - software
089 Electrical, electronic
090 Environmental
091 Industrial
092 Marine engineer or naval architect
093 Materials or metallurgical
094 Mechanical
095 Mining or geological
096 Nuclear
097 Petroleum
098 Sales
099 Other engineers

*** Engineering Technologists and Technicians
100 Electrical, electronic, industrial, mechanical
101 Drafting occupations, including computer drafting
102 Surveying and mapping
103 OTHER engineering technologists and technicians
104 Surveyors

110 **Farmers, Foresters & Fishermen**

Health Occupations

Exhibit 3. (continued)

LIST B. JOB CODES (CONTINUED)

111 Diagnosing/Treating Practitioners (e.g., dentists, optometrists, physicians, psychiatrists, podiatrists, surgeons, veterinarians)
112 Registered nurses, pharmacists, dieticians, therapists, physician assistants
113 Health Technologists & Technicians (e.g., dental hygienists, health record technologist/technicians, licensed practical nurses, medical or laboratory technicians, radiologic technologists/technicians)
114 OTHER health occupations

120 **Lawyers, Judges**

130 **Librarians, Archivists, Curators**

Managers, Executives, Administrators

(Also see 151-153)
141 Top and mid-level managers, executives, administrators (people who manage other managers)
*** All other managers, including the self-employed – Use the code that comes closest to the field you manage.

Management-Related Occupations

(Also see 141)
151 Accountants, auditors, and other financial specialists
152 Personnel, training, and labor relations specialists
153 OTHER management related occupations

Mathematical Scientists

171 Actuaries
172 Mathematicians
173 Operations research analysts, modelling
174 Statisticians
175 Technologists and technicians in the mathematical sciences
176 OTHER mathematical scientists

Physical Scientists

191 Astronomers
192 Atmospheric and space scientists
193 Chemists, except biochemists
194 Geologists, including earth scientists
195 Oceanographers
196 Physicists
197 Technologists and technicians in the physical sciences
198 OTHER physical scientists

***__Research Associates__/Assistants (Select the code that comes closest to your field)

Sales and Marketing

200 Insurance, securities, real estate, & business services
201 Sales Occupations - Commodities Except Retail (e.g., industrial machinery/ equipment/supplies, medical and dental equip/supplies)
202 Sales Occupations - Retail (e.g., furnishings, clothing, motor vehicles, cosmetics)
203 OTHER marketing and sales occupations

Service Occupations, Except Health

(Also see 111-114)
221 Food Preparation and Service (e.g., cooks, waitresses, bartenders)
222 Protective services (e.g., fire fighters, police, guards)
223 OTHER service occupations, except health

Social Scientists

231 Anthropologists
232 Economists
233 Historians, science and technology
234 Historians, except science and technology
235 Political scientists
236 Psychologists, including clinical (Also see 070)
237 Sociologists
238 OTHER social scientist

240 **Social Workers**

Teachers/Professors

251 Pre-Kindergarten and kindergarten

Exhibit 3. (continued)

LIST B. JOB CODES (CONTINUED)

252 Elementary
253 Secondary - computer, math, or sciences
254 Secondary - social sciences
255 Secondary - other subjects
256 Special education - primary and secondary
257 OTHER precollegiate area

*** Postsecondary
271 Agriculture
272 Art, Drama, and Music
273 Biological Sciences
274 Business Commerce and Marketing
275 Chemistry
276 Computer Science
277 Earth, Environmental, and Marine Science
278 Economics
279 Education
280 Engineering
281 English
282 Foreign Language
283 History
284 Home Economics
285 Law
286 Mathematical Sciences
287 Medical Science
288 Physical Education
289 Physics
290 Political Science
291 Psychology
292 Social Work
293 Sociology
294 Theology
295 Trade and Industrial
296 OTHER health specialties
297 OTHER natural sciences
298 OTHER social sciences
299 OTHER Postsecondary

Other Professions

401 Construction trades, miners & well drillers
402 Mechanics and repairers
403 Precision/production occupations (e.g., metal workers, woodworkers, butchers, bakers, printing occupations, tailors, shoe-makers, photographic process)
404 Operators and related occupations (e.g., machine set-up, machine operators and tenders, fabricators, assemblers)
405 Transportation/material moving occupations

500 **Other Occupations (Not Listed)**
501 **Teaching in non-school setting**
502 **Legal technician**

Exhibit 4.

NSF Occupational Code Categories for Tabulations

1. Computer and mathematical scientists

11 Computer and information scientists 052-055, 088
12 Mathematical scientists 172-174, 176
13 Postsecondary teachers in computer and mathematical sciences 276, 286

2. Life and related scientists

21 Agricultural and food scientists 021
22 Biological scientists 022, 023, 025, 027
23 Environmental life scientists including forestry scientists 024
24 Postsecondary teachers in life and related sciences 273, 271, 287, 297

3. Physical and related scientists

31 Chemists, except biochemists 193
32 Earth scientists, geologists, and oceanographers 192, 194, 195
33 Physicists and astronomers 191, 196
34 Other physical scientists 198
35 Postsecondary teachers in physical and related sciences 289, 277, 275

4. Social and related scientists

41 Economists 232
42 Political scientists 235
43 Psychologists 236
44 Sociologists and anthropologists 231, 237
45 Other social scientists 238, 233
46 Postsecondary teachers in social and related sciences 278, 291, 290, 293, 298

5. Engineers

51 Aerospace and related engineers 082
52 Chemical engineers 085
53 Civil and related engineers 086
54 Electrical, electronic, computer, and communications engineer 087, 089
55 Industrial engineers 091
56 Mechanical engineers 094
57 Other engineers 083, 084, 090, 092-093, 095-097, 099, 098
58 Postsecondary teachers in engineering 280

Exhibit 4. (continued)

NSF Occupational Code Categories for Tabulations (continued)

6. All other occupations (occupations other than S&E)

61 Managers and management-related occupations, 141, 151-153
62 Health and related occupations, 111-114
63 Educators other than postsecondary in science and engineering 253-254, 251-252, 255-257, 272, 274 279 281-85, 288, 292, 294-296, 299
64 Social services and related occupations 240 070 040
65 Technicians including computer programmers 026, 175 197, 100-104, 081, 051
66 Sales and marketing 200-203
67 Other occupations 010, 031-033, 120, 130, 110, 500 (501-502), 171, 234, 221-223, 401-405

APPENDIX A

ELIGIBLE AND INELIGIBLE MAJORS: 1993

ELIGIBLE SCIENCE AND ENGINEERING FIELDS

CATEGORIES & FIELDS	1993 NSF CODE	1990 CIP CODE
1. Computer and Mathematical Sciences		
11 COMPUTER & INFO SCIENCE		
COMPUTER & INFO SCI, GEN	671	11.0101
COMPUTER SCIENCE	673	11.0701
COMPUTER SYSTEMS ANALYSIS	674	11.0501
INFORMATION SCI & SYSTEMS	676	11.0401
COMPUTER & INFO SCI, OTHER	677	11.9999
12 MATHEMATICAL SCIENCES		
APPLIED MATH, GEN	841	27.0301
APPLIED MATH, OTHER	"	27.0399
MATHEMATICS, GENERAL	842	27.0101
OPERATIONS RESEARCH	843	27.0302
MATHEMATICAL STATISTICS	844	27.0501
MATHEMATICS, OTHER	845	27.9999
MATH & COMPUTER SCI	"	30.0801
2. Life and Related Sciences		
21 AGRICULTURAL & FOOD SCI		
ANIMAL SCIENCE	605	02.0201-02.0299
FOOD SCIENCES & TECHN	606	02.0301
PLANT SCIENCE	607	02.0401-02.0499
SOIL SCIENCE	608	02.0501
AGRICULTURE SCI, OTHER	"	02.9999
AGRICULTURE SCIENCE, GEN	"	02.0101-02.0102
22 BIOLOGICAL SCIENCES		
BIOCHEMISTRY & BIOPHYSICS	631	26.0202-26.0203
BIOLOGY, GEN	632	26.0101
BOTANY	633	26.0301-26.0399
CELL & MOLECULAR BIOLOGY	634	26.0401-26.0499
ECOLOGY	635	26.0603
GENETICS, ANIMAL & PLANT	636	26.0613
MICROBIOLOGY/BACTERIOLOGY	637	26.0501
NUTRITIONAL SCIENCES	638	26.0609
PHARMACOLOGY, HUMAN & ANIMAL	639	26.0705
PHYSIOLOGY, HUMAN & ANIMAL	640	26.0706
ZOOLOGY, GEN	641	26.0701
ENTOMOLOGY	"	26.0702
PATHOLOGY, HUMAN & ANIMAL	"	26.0704
ZOOLOGY, OTHER	"	26.0799

	1993 NSF CODE	1990 CIP CODE
ANATOMY	642	26.0601
MARINE/AQUATIC BIOLOGY	"	26.0607
NEUROSCIENCE	"	26.0608
PARASITOLOGY	"	26.0610
RADIATION BIOLOGY/RADIOBIOLOGY	"	26.0611
TOXICOLOGY	"	26.0612
BIOMETRICS	"	26.0614
BIOSTATISTICS	"	26.0615
BIOTECHNOLOGY RESEARCH	"	26.0616
EVOLUTIONARY BIOLOGY	"	26.0617
BIOLOGICAL IMMUNOLOGY	"	26.0618
VIROLOGY	"	26.0619
MISC BIOLOGICAL, OTHER	"	26.0699
BIOLOGICAL SCIENCE, OTHER	"	26.9999
BIOLOGICAL & PHYS SCI	991	30.0101
SYSTEMS SCIENCE & THEORY	"	30.0601
23 ENVIRONMENTAL & FORESTRY SCI		
ENVIRONMENTAL SCIENCE	680	03.0102
FORESTRY SCIENCE	681	03.0502
3. Physical and Related Sciences		
31 CHEMISTRY		
CHEMISTRY	873	40.0501-40.0599
32 EARTH SCI, GEO, OCEAN		
ATMOSPHERIC SCI & METEOR	872	40.0401
EARTH & PLANETARY SCI	874	40.0703
GEOLOGY	875	40.0601
GEOCHEMISTRY	876	40.0602
GEOPHYSICS & SEISMOLOGY	"	40.0603
PALEONTOLOGY	"	40.0604
GEOLOGICAL SCI, OTHER	"	40.0699
OCEANOGRAPHY	877	40.0702
33 PHYSICS & ASTRONOMY		
ASTRONOMY	871	40.0201
ASTROPHYSICS	"	40.0301
PHYSICS	878	40.0801-40.0899
34 OTHER PHYSICAL SCIENCE		
PHYSICAL SCIENCE, GENERAL	879	40.0101
METALLURGY	"	40.0701
MISC PHYSICAL SCI, OTHER	"	40.0799
PHYSICAL SCIENCE, OTHER	"	40.9999

	1993 NSF CODE	1990 CIP CODE
4. Social Sciences and Related Sciences		
41 ECONOMICS		
AGRICULTURE ECONOMICS	601	01.0103
ECONOMICS	923	45.0601-45.0699
42 POLITICAL & RELATED SCI		
PUBLIC POLICY ANALYSIS	902	44.0501
INTERNATIONAL REL & AFF	927	45.0901
POLITICAL SCI & GOVT	928	45.1001-45.1003
43 PSYCHOLOGY		
* EDUCATIONAL PSYCHOLOGY	704	13.0802
* CLINICAL PSYCHOLOGY	891	42.0201
COUNSELING PSYCHOLOGY	892	42.0601
EXPERIMENTAL PSYCHOLOGY	893	42.0801
GENERAL PSYCHOLOGY	894	42.0101
INDUSTRIAL/ORGANIZATIONAL PSY	895	42.0901
SOCIAL PSYCHOLOGY	896	42.1601
PSYCHOLOGY, OTHER	897	42.9999
COGNITIVE PSYCHOLOGY	"	42.0301
COMMUNITY PSYCHOLOGY	"	42.0401
DEVELOPMENTAL & CHILD PSY	"	42.0701
PHYSIOLOGICAL PSYCHOLOGY	"	42.1101
* SCHOOL PSYCHOLOGY	"	42.1701
BIOPSYCHOLOGY	"	30.1001
44 SOCIOLOGY & ANTHROPOLOGY		
ANTHROPOLOGY	921	45.0201
* ARCHEOLOGY	"	45.0301
* CRIMINOLOGY	922	45.0401
SOCIOLOGY	929	45.1101
*These were not sampled in 1993; however, they were included as eligible.		
45 OTHER SOCIAL SCIENCES		
* AREA STUDIES	620	05.0101-05.0199
* ETHNIC & CULTURAL STUDIES	"	05.0201-05.0299
* AREA,ETHNIC,CULT, OTHER	"	05.9999
LINGUISTICS	771	16.0102
PHILOSOPHY OF SCIENCE	861	45.0804 (PART)
GEOGRAPHY	924	45.0701-45.0702
HISTORY OF SCIENCE	925	45.0804 (PART)
URBAN AFFAIRS/STUDIES	930	45.1201
SOCIAL SCIENCE, OTHER	"	45.9999
SOCIAL SCIENCES, GEN	"	45.0101
DEMOGRAPHY & POP STUDIES	"	45.0501
PEACE & CONFLICT STUDIES	"	30.0501
GERONTOLOGY	"	30.1101
SCIENCE, TECHN, & SOCIETY	"	30.1501

	1993 NSF CODE	1990 CIP CODE
5. Engineering	"	
51 AERO & ASTRO ENGINEERING		
AERO & ASTRO ENGIN	721	14.0201
52 CHEMICAL ENGINEERING		
CHEMICAL ENGIN	725	14.0701
53 CIVIL & RELATED ENGIN		
CIVIL ENGINEERING	726	14.0801-14.0899
ARCHITECTURAL ENGIN	723	14.0401
54 ELECTRICAL & COMPUTER ENG		
COMPUTER ENGIN	727	14.0901
SYSTEMS ENGIN	"	14.2701
ELECTRIC,ELECTRON,COMM	728	14.1001

*These were not sampled in 1993; however, they were included as eligible.

55 INDUSTRIAL ENGINEERING		
INDUSTRIAL ENGIN	733	14.1701
56 MECHANICAL ENGINEERING		
MECHANICAL ENGIN	735	14.1901
57 OTHER ENGINEERING		
AGRICULTURAL ENGIN	722	14.0301
BIOENGIN & BIOMED ENGIN	724	14.0501
ENGINEERING MECHANICS	729	14.1101
ENGINEERING PHYSICS	"	14.1201
ENGINEERING SCIENCE	"	14.1301
ENVIRONMENTAL ENGIN	730	14.1401
ENGIN, GEN	731	14.0101
GEOPHYSICAL ENGIN	732	14.1601
MATERIALS ENGIN	734	14.1801
CERAMIC SCI & ENGIN	"	14.0601
TEXTILE SCI & ENGIN	"	14.2801
POLYMER/PLASTICS ENGIN	"	14.3201
METALLURGICAL ENGIN	736	14.2001
MINING & MINERAL ENGIN	737	14.2101
NAVAL ARCH & MARINE ENGIN	738	14.2201
NUCLEAR ENGIN	739	14.2301
PETROLEUM ENGIN	740	14.2501
ENGINEERING DESIGN	741	14.2901
ENGIN/INDUST MANAGEMENT	"	14.3001
MATERIALS SCIENCE	"	14.3101
GEOLOGICAL ENGIN	"	14.1501
OCEAN ENGIN	"	14.2401
ENGINEERING, OTHER	"	14.9999

INELIGIBLE NON-SCIENCE AND ENGINEERING FIELDS

CATEGORIES & FIELDS	1993 NSF CODE	1990 CIP CODE
OTHER, AGRI-BUSINESS	602	01.0101-01.0102
"	"	01.0104-01.9999
ARCHITECTURE	610	ALL 04
BUSINESS MANAGEMENT	651-659	ALL 08, ALL 52
COMMUNICATIONS	661-663	ALL 09
COMPUTER PROGRAMMING	672	11.0201
DATA PROCESSING TECHN	675	11.0301
OTHER, CONSERVATION	682	03.0101
"	"	03.0201-03.0501
"	"	03.0506-03.9999
CRIMINAL JUSTICE	690	ALL 43
EDUCATION	701-703	ALL 13 EXCEPT 13.0802
"	705-713	“
ENGINEERING-RELATED TECHN	751-754	ALL 15
"	"	48.0101-48.0199
ENGLISH LANGUAGE	760	ALL 23
OTHER, FOREIGN LANGUAGE	772	16.0101
"	"	16.0103-16.9999
HEALTH PROFESSIONS	781-791	ALL 51
HOME ECONOMICS	800	ALL 19, ALL 20
LAW/PRELAW/LEGAL STUDIES	810	ALL 22
LIBERAL ARTS	820	ALL 24
LIBRARY SCIENCE	830	ALL 25
PARKS RECREATION	850	ALL 31
OTHER, PHILOSOPHY	862	ALL 38, ALL 39
PUBLIC ADMINISTRATION	901	44.0401
OTHER, PUBLIC AFFAIRS	903	44.0201,44.9999
SOCIAL WORK	910	44.0701
HISTORY, OTHER	926	45.0801-45.0803
"	"	45.0805-45.0899
VISUAL & PERFORMING ARTS	941-944	ALL 50
OTHER FIELDS	995	ALL 10, ALL 12
"	"	29.0101
"	"	30.1201
"	"	30.1301
"	"	30.1401
"	"	30.9999
"	"	ALL 32 THRU 37
"	"	ALL 41, ALL 46, ALL 47
"	"	48.0201-48.9999
"	"	ALL 49